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DSSD CENSUS 2000 PROCEDURES AND OPERATIONS MEMORANDUM SERIES B-3

MEMORANDUM FOR Howard Hogan
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Subject: Quality of Census 2000 Processes (Prototype)

The attached document is a prototype of the report that we will prepare, per your request, following completion of applicable census operations. The completed report is intended to aid the Executive Steering Committee on A.C.E. Policy (ESCAP) in its recommendation regarding the release of the statistically corrected data or the data without statistical correction as the P.L. 94-171 data. This report, together with other reports, will assess the operations and results of both the initial Census and the A.C.E. Both sets of assessments will be available to the ESCAP to aid the Committee in reaching its recommendation regarding the use of the statistically corrected data.

The attached prototype contains both empty table shells and a description of textual analysis that will assess specific aspects of the applicable operations. This report focuses on the quality of Census 2000 processes.

It is important to note that the conduct of the operations may lead us to modify the attached format by including additional information. It is also likely that descriptions and definitions will be enhanced or the data items could undergo revision. Conversely, we may conclude, for a variety of reasons, that some of the information set forth in the attached prototype may not be available. The attached document sets forth our conclusions prior to completion of the A.C.E. about what information would properly inform the ESCAP on this subject, but is subject to modification.

Quality of Census 2000 Processes

prepared by Frank Vitrano, Tracey McNally, Rebecca Piegari, and Carrie Johanson

Introduction

It is important to evaluate not only the quality of the A.C.E. operations, but also the quality of the census itself for two reasons. First, if the census is of exceptional quality there would be no reason to adjust. If, for example, preliminary results indicate that the historical phenomenon of the differential undercount did not manifest itself in Census 2000, there would be no reason to use the A.C.E. results to adjust the census. Robinson (2000) deals with demographic analysis; it will address whether Census 2000 results indicate that historical differential undercount patterns have been repeated in Census 2000.

The second reason to evaluate the quality of the initial census is that A.C.E. quality relates to census quality. The A.C.E., no matter how well conducted, would be unable to adjust the census if the census itself had serious operational failures. While the A.C.E. is designed to allow it to correct the differential undercount, it can only do so if basic census operations generally function as planned. A.C.E. is premised on the overall success of the basic census operations.

The following operations were chosen for inclusion in this document because they are the basic stages of the census operation most relevant to overall census quality.

I. **Address List Compilation**

- A. Mailout/Mailback Approach
- B. Update/Leave Approach
- C. List/Enumerate Approach

II. **Enumeration**

- A. Update/Leave
- B. Mailback
- C. Be Counted Campaign

III. **Followup**

- A. Coverage Edit Followup
- B. Nonresponse Followup
- C. Coverage Improvement Followup

IV. **Data Processing**

A. Primary Selection Algorithm
B. Creation of the Census Unedited File

It is important to assess the quality of census operations in light of historical experience. Accordingly, where applicable, each of the following discussions will compare how the operation performed in Census 2000 versus how the operation performed in the 1990 census.

Please note that some of the operations have associated quality assurance (QA) programs, while others do not. All of the operations assessed in this paper will be reviewed for quality, even if there is no explicit QA program, through validation and review programs.

Overall Assessment

An overall assessment will be provided in the final version of this paper.

Census Quality Profiles

I. Address List Compilation

To support Census 2000 and other demographic data collection activities, the Census Bureau has developed a nationwide list of individual living quarters (either addresses or location descriptions) called the Master Address File (MAF). The MAF is linked to the Census Bureau's nationwide automated geographic system, the Topologically Integrated Geographic Encoding and Referencing (TIGER) data base. This means that a census block location is recorded in the MAF for each address or location description, and that each block location relates to all the higher levels of geography (e.g., census tract, incorporated place, and so on) to which the Census Bureau tabulates data.

The Census Bureau used three different approaches for initially building and subsequently improving the MAF for different geographic areas (defined at the census block level). The use of an approach depended on the types of addresses used for mail delivery and on population enumeration considerations. These approaches are identified by the primary types of enumeration areas that they contain: Mailout/Mailback, Update/Leave, and List/Enumerate.

A. Mailout/Mailback Approach

This approach includes the following types of enumeration areas: Mailout/Mailback, Military Blocks in otherwise Update/Leave Areas, Urban Update/Leave, and Urban Update/Enumerate.

The majority of addresses in the country are in census blocks where the Census Bureau used the Mailout/Mailback approach for address list development. In these areas, the U.S. Postal Service (USPS) uses, for the most part, city-style addresses for mail delivery. A city-style address contains a house number and street name (for example, 101 Main Street) and may also contain identifiers for specific housing units within a structure (for example, Apartment 2). The address list in these areas was initially created by using addresses from the 1990 census and addresses from a USPS file.

1. 1990 Census Address Control File and an initial Delivery Sequence File from the U.S. Postal Service

   a. Census 2000

      Since 1995, under the provisions of Public Law 103-430 and a subsequent Memorandum of Understanding with the Census Bureau, the USPS has periodically provided to the Census Bureau its list of individual mail delivery points, known as the Delivery Sequence File (DSF). Initially the Census Bureau used the DSF to update the streets, street names, and address ranges in the TIGER data base, from the 1990 census, in order to improve TIGER's ability to later assign block codes to individual MAF addresses.

      Subsequently, the Census Bureau used the DSF in the initial creation of the MAF by using it to update the 1990 census housing unit address list (the 1990 census Address Control File). For the majority of the country, the initial update of the 1990 Address Control File was done with the November 1997 DSF. Earlier DSFs were used in areas of the country that were involved in tests of the American Community Survey or in the Census 2000 Dress Rehearsal.

      The merging of information from the DSF with the 1990 census Address Control File was not straightforward since the Census Bureau and the USPS use address lists for different purposes and therefore have differences in address list requirements. For example, the Census Bureau requires a record of each housing unit (apartment) in a multi-unit structure while in some cases the USPS requires only the basic street address for the structure.

   b. 1990 Census

      In 1990, the Census Bureau did not use the previous census' address list as the starting point for building its address list. The initial list

was created both by using commercial address lists and by field listing operations. In the 1990 census, the Census Bureau did not receive files of addresses from the USPS. However, the USPS did assist the Census Bureau by conducting the Advanced Post Office Check. In this operation, the addresses of all known living quarters were computer printed on cards. These cards were sorted by ZIP Code and letter carrier route and shipped to the respective Post Office. Letter carriers sorted the cards into slots for each address on their route, made corrections, identified duplicates and undeliverable addresses, and added new addresses.

c. Data

Number and characteristics of housing units used from the 1990 census Address Control File and number and characteristics of housing units in the November 1997 (or earlier) DSF

d. Quality Assurance

While there were no formal quality assurance checks associated with this operation, edits were performed on the matching process to guarantee its quality.

2. Local Update of Census Addresses 1998

a. Census 2000

Following the initial creation of the address list, the Census Bureau began the Local Update of Census Addresses (LUCA) program. P. L. 103-430 calls for the Census Bureau to work with tribal, state, and local governments to improve the MAF. In Mailout/Mailback areas, this program is referred to as LUCA 1998. In this program, the Census Bureau sent invitations for participation to all eligible functioning local and tribal governments. These governments contained at least some census blocks that were in Mailout/Mailback enumeration areas. For those governments that agreed to participate and signed a confidentiality agreement, the Census Bureau provided address lists and census maps. Local and tribal governments could either receive paper or electronic materials. Participants were asked to provide updates and corrections to the address lists and maps. These updates included:

(1) correcting existing addresses
(2) deleting addresses on the list that did not exist

(3) adding new addresses to the list
(4) correcting the names and locations of features on the census maps

Local and tribal governments could return updates either electronically or on paper. The National Processing Center keyed all paper address updates and, independently, they data captured map feature updates by scanning and digitizing updated census map information. The Geography Division then updated the MAF and TIGER databases with the electronically provided updates and the data captured updates.

The original intent was to incorporate these LUCA 1998 updates into the MAF and TIGER prior to producing materials for conducting the block canvassing operation (see the later section on block canvassing) for all participating governments. However, this only occurred for a small number of local and tribal governments. For most local and tribal governments, initial LUCA submissions were provided at the same time as the block canvassing operation. For approximately 700 local and tribal governments, the results of block canvassing were incorporated into the MAF prior to producing any materials for the governments' review. This was done because the address lists for these governments were determined to be deficient by comparing current MAF counts with 1990 housing unit counts. The Census Bureau decided to postpone the review for these entities until the Block Canvassing operation was completed and its results were added to the MAF.

b. 1990 Census

In the 1990 census, there was no opportunity for local and tribal governments to provide individual address list updates prior to the enumeration. There was a Pre-Census Local Review which provided governments an opportunity to review housing unit counts for their political jurisdiction. For any discrepancies identified in this process that could not be resolved in the office, blocks were recanvassed.

c. Data

Participation rates (including those willing to participate and those who provided actual updates), number and characteristics of housing units added, deleted, or corrected from the initial LUCA submissions

d. Quality Assurance

While there were no formal quality assurance checks associated with this operation, resulting new addresses were sent to the LUCA 1998 Field Verification program. This program had a quality assurance plan ensuring the quality of these address adding procedure.

3. September 1998 Delivery Sequence File (DSF)

a. Census 2000

Ten months following the initial address list creation, the USPS sent the Census Bureau the September 1998 DSF. This file contained all addresses currently in the DSF, not just changes from the previous delivery. The Geography Division updated the MAF by adding new addresses and updating existing addresses with address corrections. If an address was no longer on the DSF or was now coded as a non-residential address, this information was updated on the MAF as well. Because of the timing of this update, most LUCA 1998 participants did not receive initial address lists from the Census Bureau with the September 1998 DSF updates incorporated, but some did.

b. 1990 Census

The only update from the USPS during the 1990 census was the Casing Check. In this operation, conducted between February and March of 1990, each letter carrier conducted an operation similar to the Advanced Post Office Check that is described in the section above on the "1990 Census Address Control File and an Initial Delivery Sequence File from the U.S. Postal Service."

c. Data

Number and characteristics of housing units in the September 1998 DSF will be available.

d. Quality Assurance

While there were no formal quality assurance checks associated with this operation, edits were performed on the matching process to guarantee its quality.

4. Block Canvassing

a. Census 2000

Following the update of the MAF with the September 1998 DSF and some LUCA 1998 results, the Block Canvassing operation occurred in the winter/spring of 1999. Prior to this operation occurring, field staff were given one last opportunity to review specific census blocks and to decide whether the address list should be developed using this Mailout/Mailback approach or whether it should convert to the Update/Leave approach.

For blocks that remained in the Mailout/Mailback approach, field staff updated the address list and maps by canvassing every block and attempting to contact persons at every multi-unit address, every new address, and every third single unit address in order to confirm the address information in the MAF. Canvassers were asked to provide updates and corrections to the address lists and maps. These updates included:

(1) verifying all existing addresses
(2) correcting existing addresses
(3) deleting addresses on the list that did not exist
(4) adding new addresses to the list
(5) correcting the names and locations of features on the census maps

The National Processing Center keyed all address updates and, independently, they data captured map feature updates by scanning and digitizing updated census map information. The Geography Division then updated the MAF and TIGER databases with the data captured updates. Note that while the MAF was being updated, the Geography Division could identify block corrections through matching addresses deleted from one block to addresses added in another block.

Once block canvassing results were incorporated in the MAF, the initial Decennial MAF was produced. This file was the initial source of addresses to be mailed census forms.

b. 1990 Census

In the 1990 census, the Census Bureau conducted an operation, called Precanvass, to improve its address list. In the Precanvass operation, census workers canvassed streets where they:

(1) updated the census address list with missing addresses,
(2) made corrections to existing addresses,
(3) corrected census geography, and
(4) identified duplicate, nonexistent, and commercial addresses.

c. Data

Number and characteristics of housing units added, deleted, verified, or corrected from block canvassing and housing units whose block codes were corrected.

d. Quality Assurance

The QA plan for the Block Canvassing operation was designed to achieve the following objectives:

(a) to assure that no significant differences occur between what appears on the ground, and the housing unit information in the Address Binder (AB), and the geographic features on the maps
(b) to assure that coverage errors are not concentrated in small geographic areas; and
(c) to provide continuous feedback to the canvasser for performance improvement.

Unintentional errors were prevented by reviewing each enumerator's work at the beginning of their first assignment. A crew leader or assistant conducted this initial and weekly observations to ensure the enumerator produced work according to the established procedures. The crew leader or assistant observed the enumerator working in the field for a total of ten cases. For QA purposes, we assumed the crew leader or assistants did not make any errors since they have received more training than the enumerators. One limitation of this QA check is that it was not a representative sample of the enumerator's work, so no inferences can be made regarding the quality of the enumerator's work – only the enumerator's ability.

Significant coverage and content errors were identified during a dependent review of each assignment area (AA) or during an office review of each AA. While in the field performing the initial and weekly reviews, the Crew Leader (CL) or Crew Leader's Assistant (CLA) reviewed a sample of areas in the AB already canvassed. The CL recorded HUs sampled and the type of error(s) identified to make a determination whether it was acceptable. If there were two or more

critical errors, the entire AA was rejected and was recanvassed. When the review was acceptable, the AA was sent to the field office. For QA purposes, we assumed the crew leader or assistants did not make any errors since they have received more training than the enumerators. An office clerk performed the office review by reviewing 100 percent of housing units listed in the address binders. When an address binder did not meet the acceptable quality level, it was returned to the enumerator for corrections.

To improve enumerator performance, the crew leader provided feedback to the enumerators. Following the initial and weekly observations, the crew leader or assistant informed the enumerator of any errors observed and retrained the enumerator, as needed, to correct the errors. Upon completion of the dependent review, the crew leader or assistant again informed the enumerator of any errors and retrained the enumerator as necessary.

(1) QA plan characteristics

The QA program consisted of four main activities: Initial Observation, Weekly Observation, Dependent Review, and an Office Review. Each activity is discussed with its characteristics below.

(a) Initial observation

- QA sample - 100 percent of enumerators
- Acceptable number of critical errors = 0
- AOQL is not applicable due to 100 percent sample

(b) Weekly observation

- QA sample - 100 percent of enumerators
- Acceptable number of critical errors = 0
- AOQL is not applicable due to 100 percent sample

(c) Dependent review

- QA sample - approximately 6 percent of housing units
- Acceptable number of critical errors = 1
- AOQL = 2 percent

(d) Office review

- QA sample - 100 percent of address binders

- Acceptable number of critical errors < 5 percent
- AOQL is not applicable due to 100 percent sample

(2) QA results

(a) How well did the enumerators perform during production?

	Total number of Enumerators	% of Enumerators Passed	% of Enumerators Failed
Initial Observation			
Weekly Observation			

	Total number of AAs	% of AAs Passed	% of AAs Failed
Dependent Review			
Office Review			

(b) What type and magnitude of errors were experienced during production?

	Delivery Errors	Listing Errors		Mapping Errors	
		Failure to add HU (Under coverage)	Failure to correct HU	Failure to add feature	Failure to delete feature
Initial Observation					
Weekly Observation					
Dependent Review	N/A				
Office Review	N/A				

(c) How much work was corrected or redone due to failure of a QA checkpoint?

	Number of AAs reworked	Number of HUs reworked	% of workload reworked
Initial Observation *			
Weekly Observation *			
Dependent Review			
Office Review			

* The Initial and Weekly Observations can occur at any time during an AA. If an enumerator fails the Initial or Weekly Observation, he/she will rework all completed cases from the beginning of the AA. This number is not recorded, therefore we assume the maximum number of cases to be reworked is equal to the number of HUs in the AA.

(3) Comparison to 1990 results

The Block Canvassing operation was not conducted in the 1990 census.

(4) Conclusions

Will be completed after results are available. The conclusions will address the quality of the Block Canvassing program as measured by its quality control operation and present the

- Reasons
- Limitations
- Recommendations

surrounding those conclusions.

5. 1998 LUCA Field Verification

a. Census 2000

Once the results of block canvassing were incorporated into the MAF, subsequent LUCA operations could take place. The next steps depended on the relationship between the LUCA operation and the block canvassing operation for each participating government.

For those governments whose updates were incorporated into the MAF before the block canvassing operation, any discrepancies identified by the block canvassing operation were provided back to them as feedback to their initial submissions. In these situations, field verification was not needed because block canvassing was the field verification.

For those governments whose MAF addresses were considered deficient when compared to 1990 address counts, these governments were finally provided their initial address lists for review. Note that in this situation, any adds and corrections provided by the local and tribal governments were accepted and included in the census process without being field verified.

For those governments who provided updates independent of the block canvassing operation, the Census Bureau compared the results of these two operations. When there were discrepancies, the discrepant units were sent to be verified in the field during LUCA Field Verification. At this time, any units identified as deletes in the block canvassing operation were also sent to the field to verify the delete status. In LUCA Field Verification, field staff were required to verify all addresses provided to them and make any corrections to the list. Possible updates in the field verification operation included:

(1) Verification of an existing address
(2) Deletion of an address
(3) Address correction or a change of status to nonresidential addresses

The National Processing Center keyed all address updates and, independently, they data captured map feature updates by scanning and digitizing updated census map information. The Geography Division then updated the MAF and TIGER databases with the data captured updates. Once all updates were made, the Census Bureau provided feedback to the local or tribal governments on their initial submissions. Note that the initial Decennial MAF was created without the resolution of discrepancies between LUCA 1998 and block canvassing and without verification of block canvass deletes. That is, unverified LUCA adds and unverified block canvass deletes were included in the Decennial MAF and in the mailout of questionnaires. Now that LUCA 1998 Field Verification had taken place, any confirmed deletes that were mailed census questionnaires would be kept out of the Nonresponse Follow up operation.

b. 1990 Census

Since there was no opportunity for local and tribal governments to provide address list updates prior to the enumeration in the 1990 census, there was no verification of such updates.

c. Data

Number and characteristics of addresses that were sent to LUCA Field Verification and the number verified, deleted, corrected, or changed to being non-residential.

d. Quality Assurance

The QA plan for the LUCA 1998 Field Verification operation was designed to achieve the following objectives:

(a) to control against significant misclassification of deletes.
(b) to provide continuous feedback to the canvasser for performance improvement.

Unintentional errors were prevented by reviewing each enumerator's work at the beginning of their first assignment. A crew leader or assistant conducted this initial observation to ensure the enumerator produced work according to the established procedures. The crew leader or assistant observed the enumerator working in the field for a total of ten cases. For QA purposes, we assumed the crew leader or assistants did not make any errors since they have received more training than the enumerators. One limitation of this QA check is that it was not a representative sample of the enumerator's work, so no inferences can be made regarding the quality of the enumerator's work – only the enumerator's ability.

Significant coverage and content errors were identified during a dependent review or during an office review of each AA. The Crew Leader (CL) or Crew Leader's Assistant (CLA) reviewed a sample of areas in the Address Binder (AB) already canvassed. The CL recorded HUs sampled and error(s) identified. If there was one or more critical error, the CL continued to verify the Field Assignment (FA). When the review was acceptable, the FA was sent to the field office. For QA purposes, we assumed the crew leader or assistants did not make any errors since they received more training than the enumerators. An office clerk performed the office review by reviewing 100 percent of housing units listed in the address binders. When an address binder did not meet the acceptable quality level, it was returned to the enumerator for corrections.

To improve enumerator performance, the crew leader provided feedback to the enumerators. Following the initial observations, the crew leader or assistant informed the enumerator of any errors observed and retrained the enumerator, as needed, to correct the

errors. Upon completion of the dependent review, the crew leader or assistant again informed the enumerator of any errors and retrained the enumerator as necessary.

(1) QA plan characteristics

The QA program consisted of three main activities: Initial Observation, Dependent Review, and an Office Review. Each activity is discussed with its characteristics below.

(a) Initial observation

- QA sample - 100 percent of enumerators
- Acceptable number of critical errors = 0
- AOQL is not applicable due to 100 percent sample

(b) Dependent review

- QA sample - approximately 12.5 percent of housing units
- Acceptable number of critical errors = 0

(c) Office review

- QA sample - 100 percent of address binders
- Acceptable number of critical errors < 5 percent
- AOQL is not applicable due to 100 percent sample

(2) QA results

(a) How well did the enumerators perform during production?

	Total number of Enumerators	% of Enumerators Passed	% of Enumerators Failed
Initial Observation			

	Total number of AAs	% of AAs without Error
Dependent Review		

(b) What type and magnitude of errors were experienced during production?

	Delivery Errors	Listing Errors		Mapping Errors	
		Failure to add HU (Under coverage)	Failure to correct HU	Failure to add feature	Failure to delete feature
Initial Observation					

(c) How much work was corrected or redone due to failure of a QA checkpoint?

	Number of AAs reworked	Number of HUs reworked	% of workload reworked
Initial Observation *			
Dependent Review			

* If an enumerator fails the Initial Observation, he/she will rework all completed cases from the beginning of the AA. This number is not recorded, therefore we assume the maximum number of cases to be reworked is equal to the number of HUs in the AA.

(3) Comparison to 1990 results

The LUCA 1998 Field Verification operation was not conducted in the 1990 census.

(4) Conclusions

Will be completed after results are available. The conclusions will address the quality of the LUCA 1998 Field Verification program as measured by its quality control operation and present the

- Reasons
- Limitations
- Recommendations

surrounding those conclusions.

6. November 1999 Delivery Sequence File (DSF)

a. Census 2000

In late 1999, the USPS sent the Census Bureau the November 1999 DSF. This file contained all addresses currently in the DSF, not just changes from the previous delivery. The Geography Division updated

the MAF by adding new addresses and updating existing addresses with address corrections. If an address was no longer on the DSF or was now coded as a non-residential address, this information was updated on the MAF as well. Any added addresses that could be assigned to a census block were added to the mailout of census questionnaires.

b. 1990 Census

See September 1999 DSF section

c. Data

Number and characteristics of housing units in the November 1999 DSF

d. Quality Assurance

While there were no formal quality assurance checks associated with this operation, edits were performed on the matching process to guarantee its quality.

7. The New Construction Program

a. Census 2000

Once the November 1999 DSF updates were made to the MAF, Local and Tribal governments were given one more opportunity to assist in ensuring the completeness of the MAF for Census 2000 in the New Construction Program. Starting in January 2000, the Census Bureau provided participating governments an updated MAF to review. Local and tribal governments were asked to provide addresses for any residential structures newly constructed and existing as of Census Day, April 1, 2000. Any new addresses provided at this time were enumerated during the Coverage Improvement Follow up operation.

b. 1990 Census

There was no New Construction program in the 1990 census.

c. Data

Participation rates (including those willing to participate and those who provided actual updates), number and characteristics of housing units added from the New Construction submissions.

d. Quality Assurance

No formal quality assurance was developed for the operation since new construction units were included in the Coverage Improvement Follow Up operation. See details of the Coverage Improvement Follow Up QA plan in section IIIC.

8. February & April 2000 Delivery Sequence Files (DSF)

a. Census 2000

The USPS provided two more updated DSFs that the Census Bureau incorporated into the MAF for Census 2000. In February 2000, the USPS provided a special file of just new units since the November 1999 delivery. In April 2000, the USPS provided a file with all addresses currently in the DSF, not just changes from the previous delivery. The Geography Division updated the MAF by adding new addresses and updating existing addresses with address corrections. If an address was no longer on the DSF or was now coded as a non-residential address, this information was updated on the MAF as well. Depending on the timing of obtaining a block code for any new addresses from these DSFs, these addresses were either enumerated during Nonresponse Follow up or during Coverage Improvement Follow up.

b. 1990 Census

See September 1999 DSF section

c. Data

Number and characteristics of housing units used in the February and April 2000 DSFs

d. Quality Assurance

While there were no formal quality assurance checks associated with this operation, edits were performed on the matching process to guarantee its quality.

9. LUCA 1998 Appeals

a. Census 2000

Once local and tribal governments were given feedback on their initial submissions, they had an opportunity to appeal the Census Bureau's status for any given submission. The Census Address List Appeals Office was established as a temporary office, in the Office of Management and Budget, outside the Department of Commerce to resolve appeals cases. If the Appeals Office ruled in favor of the local or tribal government, the Census Bureau would attempt an enumeration at the appealed address.

b. 1990 Census

Since there was no opportunity in 1990 for local and tribal governments to provide address list updates prior to the enumeration, there were no appeals of such updates.

c. Data

Number and characteristics of appealed addresses and the final decision of the Appeals Office.

d. Quality Assurance

No formal quality assurance was developed for this operation.

B. Update/Leave Approach

This approach included the following types of enumeration areas: Update/Leave, Rural Update/Enumerate, and Update/Leave Areas that were originally Mailout/Mailback Areas.

Outside of Mailout/Mailback areas, non-city-style addresses are more common. Non-city-style addresses occur in the forms of rural route/box numbers, post office box numbers, highway contract route numbers, and general delivery addresses. It is difficult to establish their census block locations through automated matching because they are less systematic and are not always associated with the location of the residence (especially in the case of post office boxes and general delivery addresses). Thus, the initial MAF creation method for areas where these types of addresses predominate is through field compilation by census staff. In Update/Leave areas, the address list was initially created by using address listing.

1. Address Listing

a. Census 2000

Address Listing occurred from August of 1998 through May of 1999. In this operation, field staff created an address list by listing all residential addresses in these areas and simultaneously adding the addresses to Census maps with a location designation known as a map spot. Listers were also expected to correct the names and locations of features on the census maps.

The National Processing Center keyed all addresses and, independently, they data captured map spots and map feature updates by scanning and digitizing updated census map information. The Geography Division then updated the MAF and TIGER databases with the data captured information.

b. 1990 Census

The 1988 National Prelist Operation was the first address compilation operation conducted to obtain address data for small cities, suburban, and rural areas for the 1990 census. Part of its objectives were:

(1) to obtain a complete address,
(2) to record the physical location description and householder name for living quarters that did not have house number/street name mailing addresses, and
(3) to annotate census maps to show the location of all living quarters and to identify features and feature name changes.

The 1989 National Prelist Operation was performed to create an address list in areas where Census Bureau questionnaires would be hand-delivered. This delivery methodology, called update/leave, was used in rural areas in the South and Midwest where the Census Bureau had reason to believe that there would be problems associated with developing an accurate mailing list and problems delivering a census questionnaire.

c. Data

Number and characteristics of housing units added in the address listing operation

d. Quality Assurance

The QA plan for the Address Listing operation was designed to 1) prevent listing and mapping errors address due to a lack of understanding of the job, and 2) to assure that coverage errors are not concentrated in small geographic areas.

Unintentional errors were prevented by reviewing each enumerator's work at the beginning of their first assignment. A crew leader or assistant conducted a Qualifying observation to ensure the enumerator could produce work according to established procedures.

Any significant coverage and content errors were identified during a dependent review of each assignment area (AA) or during an office review of each AA.

2. Local Update of Census Addresses (LUCA) 1999, LUCA 1999 Recanvass, and LUCA 1999 Appeals

a. Census 2000

Following the initial creation of the address list, the Census Bureau began the Local Update of Census Addresses (LUCA) 1999 program. In this program, the Census Bureau sent invitations for participation to all eligible functioning local and tribal governments. These governments contained at least some census blocks that were in Update/Leave areas. For those governments that agreed to participate and signed a confidentiality agreement, the Census Bureau provided address lists, census maps, and counts of addresses by census block. Local and tribal governments could either receive paper or electronic materials. Participants were asked to identify census blocks where they believed the block counts were incorrect (higher or lower).

All eligible challenged blocks were recanvassed in LUCA 1999 Recanvass. In this operation, field staff recanvassed the entire block to verify all addresses on the address list, to make corrections to the list, and to add any missing addresses from the list. Staff were also expected to update the census maps with corrected names and locations of features and to add any new addresses as map spots on the maps.

The National Processing Center keyed all address updates and, independently, they data captured map spots and map feature updates by scanning and digitizing updated census map information. The Geography Division then updated the MAF and TIGER databases with

the data captured information. Once all updates were made, the Census Bureau provided feedback on the challenged blocks to the local and tribal governments. In the meantime, the initial Decennial MAF was produced. This file was the initial source of addresses to be delivered by enumerators.

Once local and tribal governments were given feedback on the challenged blocks, they had an opportunity to appeal individual addresses that they believed were still missing from the address list. The Census Address List Appeals Office was established as a temporary office, in the Office of Management and Budget, outside the Department of Commerce to resolve appeals cases. If the Appeals Office ruled in favor of the local or tribal government, the Census Bureau would attempt an enumeration at the appealed address, by mailing out questionnaires and by including these addresses in Nonresponse Follow up if the questionnaires are not returned.

b. 1990 Census

In the 1990 census there was a Pre-Census Local Review which provided governments an opportunity to review housing unit counts for their political jurisdiction. For any discrepancies identified in this process that could not be resolved in the office, blocks were recanvassed.

c. Data

Participation rates (including those willing to participate and those who challenged specific block counts), number of challenged blocks and the number of initial housing units in those blocks, the number and characteristics of housing units added, deleted, or corrected from the LUCA Recanvass operation, and the number and characteristics of appealed addresses and the final decision of the Appeals Office.

d. Quality Assurance

The QA plan for the LUCA 1999 Recanvass was designed to achieve the following objectives:

(a) to assure that no significant differences occur between what appears on the ground, and the housing unit information in the AB, and the geographic features on the maps
(b) to assure that coverage errors are not concentrated in small geographic areas; and

(c) to provide continuous feedback to the canvasser for performance improvement.

Unintentional errors were prevented by reviewing each enumerator's work at the beginning of their first assignment. A crew leader or assistant conducted this initial observation to ensure the enumerator produced work according to the established procedures. The crew leader or assistant observed the enumerator working in the field for a total of ten cases. For QA purposes, we assumed the crew leader or assistants did not make any errors since they have received more training than the enumerators. One limitation of this QA check is that it was not a representative sample of the enumerator's work, so no inferences can be made regarding the quality of the enumerator's work – only the enumerator's ability.

Significant coverage and content errors were identified during a dependent review or during an office review of each FA. The Crew Leader (CL) or Crew Leader's Assistant (CLA) reviewed a sample of areas in the Address Binder (AB) already canvassed. The CL recorded HUs sampled and the type of error(s) identified to make a determination whether it was acceptable. If there was one or more critical error, the work unit, or Field Assignment (FA) was rejected and recanvassed. For QA purposes, we assumed the crew leader or assistants did not make any errors since they received more training than the enumerators. An office clerk performed the office review by reviewing 100 percent of housing units listed in the address binders. When an address binder did not meet the acceptable quality level, it was returned to the enumerator for corrections.

To improve enumerator performance, the crew leader provided feedback to the enumerators. Following the initial observations, the crew leader or assistant informed the enumerator of any errors observed and retrained the enumerator, as needed, to correct the errors. Upon completion of the dependent review, the crew leader or assistant again informed the enumerator of any errors and retrained the enumerator as necessary.

(1) QA plan characteristics

The QA program consisted of three main activities: Initial Observation, Dependent Review, and an Office Review. Each activity is discussed with its characteristics below.

(a) Initial observation

- QA sample - 100 percent of enumerators
- Acceptable number of critical errors = 0
- AOQL is not applicable due to 100 percent sample

(b) Dependent review

- Acceptable number of critical errors = 0

(c) Office review

- QA sample - 100 percent of address binders
- Acceptable number of critical errors < 5 percent
- AOQL is not applicable due to 100 percent sample

(2) QA results

(a) How well did the enumerators perform during production?

	Total number of Enumerators	% of Enumerators Passed	% of Enumerators Failed
Initial Observation			

	Total number of AAs	% of AAs Passed	% of AAs Failed
Dependent Review			

(b) What type and magnitude of errors were experienced during production?

	Delivery Errors	Listing Errors		Mapping Errors	
		Failure to add HU (Under coverage)	Failure to correct HU	Failure to add feature	Failure to delete feature
Initial Observation					
Dependent Review	N/A				

(c) How much work was corrected or redone due to failure of a QA checkpoint?

	Number of AAs reworked	Number of HUs reworked	% of workload reworked
Initial Observation *			
Dependent Review			

* If an enumerator fails the Initial Observation, he/she will rework all completed cases from the beginning of the AA. This number is not recorded, therefore we assume the maximum number of cases to be reworked is equal to the number of HUs in the AA.

(3) Comparison to 1990 results

The LUCA 1999 Recanvass was not conducted in the 1990 census.

(4) Conclusions

Will be completed after results are available. The conclusions will address the quality of the LUCA 1999 Recanvass program as measured by its quality control operation and present the

- Reasons
- Limitations
- Recommendations

surrounding those conclusions.

C. List/Enumerate Approach

This approach includes the following types of enumeration areas: List/Enumerate and Remote Alaska.

For a small number of areas, instead of using the Update/Leave approach, the Census Bureau used the List/Enumerate approach.

1. Census 2000

In these areas, there was no address list development prior to enumeration. At the time of enumeration, enumerators developed the address list, updated maps with map spots for each added address and with feature name and location corrections, and enumerated all identified housing units, in person.

2. 1990 Census

In the 1990 census, the Census Bureau enumerated approximately 5.5 million housing units using the list/enumerate methodology. List/enumerate was used mainly in remote and sparsely settled rural areas and some seasonal housing areas of the country. About a week before Census Day, the USPS delivered Advance Census Reports to all known residential addresses in these areas. A member of the household was asked to complete the questionnaire and hold it for pick-up by an enumerator. Enumerators canvassed the areas, listed the address of each residential address, and updated the census maps. They also picked up or completed a questionnaire for every address they listed.

3. Data

Number and characteristics of housing units listed in the list/enumerate operation.

4. Quality Assurance

Two different Quality Assurance plans were undertaken in List/Enumerate areas–one for remote Alaska and one for the remaining List/Enumerate areas in the contiguous states. Analyses of these three plans, similar to the QA analyses given above, e.g., for the 1999 LUCA Recanvass program (section IB2d), will be presented.

II. Enumeration

We will assess the quality of the three major enumeration methods undertaken in Census 2000.

A. Update/Leave

1. Census 2000

Update/Leave (U/L) is an operation for updating address binders and map spots, and delivering questionnaires to all housing units in areas of the country where there may not be a city-style (i.e., house number and street name) address. The enumerators in U/L were responsible for:

- Delivering the correct pre-addressed census questionnaire to each housing unit or preparing an unaddressed questionnaire for housing units missing from the address binders.

- Updating features on the maps to reflect ground truth, verifying existing map spots, and adding map spots for housing units missing from the address binders.

- Assigning the appropriate action code to each housing unit in the address binders and listing any housing units missing from the address binders on the add pages.

- Identifying any special places missing from the address binders, marking the location of the map spot and number of the block map, and notifying the appropriate special places personnel.

2. 1990 Census

In 1990, the Update/Leave universe represented the rural but not too remote regions of the country. The selection of areas for the Update/Leave enumeration methodology depends upon the address types, such as a high percentage of rural route box numbers, post office box numbers, general delivery, and star route addresses.

3. Data

Will add workloads and breakdowns of addresses.

4. Quality Assurance

The QA plan for the Update/Leave operation was designed to achieve the following objectives:

- Prevent errors caused by lack of understanding on the part of the enumerator.
- Identify and correct significant coverage and content errors.
- Improve enumerator performance throughout the operation.

Unintentional errors were prevented by reviewing each enumerator's work at the beginning of their first assignment. A crew leader or assistant conducted this initial observation to ensure the enumerator produced work according to the established procedures. The crew leader or assistant observed the enumerator working in the field for a total of ten cases. For QA purposes, we assumed the crew leader or assistants did not make any errors since they have received more training than the enumerators. One limitation of this QA check is that it was not a representative sample of the enumerator's work, so no inferences can be made regarding the quality of the enumerator's work – only the enumerator's ability.

Significant coverage and content errors were identified during a dependent review of each assignment area (AA) or during an office review of each AA. When AAs with unacceptable levels of errors were identified, the entire AA was reworked. A crew leader or assistant performed this dependent review by selecting and reviewing twelve random cases within the AA. For QA purposes, we assumed the crew leader or assistants did not make any errors since they received more training than the enumerators. An office clerk performed the office review by reviewing 100 percent of housing units listed in the address binders. When an address binder did not meet the acceptable quality level, it was returned to the enumerator for corrections.

To improve enumerator performance, the crew leader provided feedback to the enumerators. Following the initial observation, the crew leader or assistant informed the enumerator of any errors observed and retrained the enumerator, as needed, to correct the errors. Upon completion of the dependent review, the crew leader or assistant again informed the enumerator of any errors and retrained the enumerator as necessary.

a. QA plan characteristics

The QA program consisted of three main activities: Initial Observation, Dependent Review, and an Office Review. Each activity is discussed with its characteristics below.

(1) Initial observation

- QA sample - 100 percent of enumerators
- Acceptable number of critical errors = 0
- AOQL is not applicable due to 100 percent sample

(2) Dependent review

- QA sample - approximately 6 percent of housing units
- Acceptable number of critical errors = 1
- AOQL = 6.2 percent, occurs at percent defective = 13 percent

(3) Office review

- QA sample - 100 percent of address binders
- Acceptable number of critical errors < 5 percent
- AOQL is not applicable due to 100 percent sample

b. QA results

(1) How well did the enumerators perform during production?

To assess the Initial Observation, we will provide the total number of enumerators who worked in the operation, the percent of enumerators that passes the Initial Observation, and the percent of enumerators that failed the Initial Observation.

The table below shows the results from the Dependent Review and the Office Review.

	Total number of AAs	% of AAs Passed	% of AAs Failed
Dependent Review			
Office Review			

(2) What type and magnitude of errors were experienced during production?

	Delivery Errors	Listing Errors		Mapping Errors	
		Failure to add HU (Under coverage)	Failure to correct HU	Failure to add feature	Failure to delete feature
Initial Observation					
Dependent Review	N/A				
Office Review	N/A				

(3) How much work was corrected or redone due to failure of a QA checkpoint?

	Number of AAs reworked	Number of HUs reworked	% of workload reworked
Initial Observation *			
Dependent Review			
Office Review			

* The Initial Observation can occur at any time during the first AA. If an enumerator fails the Initial Observation, he/she will rework all completed cases from the beginning of the AA. This number is not recorded, therefore we assume the maximum number of cases to be reworked is equal to the number of HUs in the AA.

c. Comparison to 1990 results

There was no QA evaluation performed on the data for the 1990.

d. Conclusions

Will be completed after results are available. The conclusions will address the quality of the Update/Leave program as measured by its quality control operation and present the

- Reasons
- Limitations
- Recommendations

surrounding those conclusions.

B. Mailback

1. Census 2000

In Census 2000, the questionnaire mailout/mailback system was the primary means of census-taking. Cities, towns, and suburban areas with city-style addresses (house number and street name) as well as rural areas where city-style addresses are used for mail delivery comprised the mailout/mailback areas. Update/leave areas consist of addresses that are predominantly not city-style. Census enumerators delivered addressed questionnaires to update/leave housing units. Update/leave enumerators also made any necessary corrections or additions to Census maps and address lists as they delivered the questionnaires. In both delivery

methodologies, the housing units were provided with first-class postage paid envelopes for returning their questionnaires.

Census 2000 included two types of questionnaires for mailback:

- A short form was delivered to approximately 83 percent of all housing units. This form allowed the respondent to list up to 12 household members. It provided space for reporting the basic population and housing data for up to six household members and the housing unit.

- A long form was delivered to a sample – approximately 17 percent – of all housing units. This form allowed the respondent to list up to 12 household members. It included all of the short form questions, as well as additional questions on the characteristics for up to six household members and the housing unit.

There was one difference between the mailout/mailback questionnaire and the update/leave questionnaire. The update/leave questionnaire gave the respondent the opportunity to correct address information.

2. 1990 Census

In the 1990 census, the United States Postal Service (USPS) was the primary vehicle for delivering census questionnaires. The Bureau mailed questionnaires to the vast majority of housing units in the country. Occupants were asked to complete the forms and mail them back in the provided postage paid envelope. In areas designated as update/leave, enumerators visited housing units, verified addresses, and left questionnaires for occupants to complete and mail back in the provided postage paid envelope.

Staff calculated the mail response rate by dividing the number of mail returns by the total mailout, with the denominator including vacant and nonexistent as well as occupied housing units. The national mail response rate was 65 percent, and nonresponse followup (NRFU) was planned based on housing units that had not returned their questionnaires.

The mail return rate was defined as the ratio of the number of households returning a census questionnaire by mail to the total number of occupied housing units that received a census questionnaire delivered by mail or by a census enumerator. For the 1990 census the overall mail return rate was approximately 74.1 percent.

3. Data

Will add final mail response rates and mail return rates.

4. Quality Assurance

No formal quality assurance program was developed for the mailout/mailback operation. The Undeliverable As Addressed and Nonresponse Followup operations were designed to correct any errors that might have occurred in the delivery process.

C. Be Counted Campaign

1. Census 2000

The Be Counted Program provided a means for people to be included in Census 2000 who may not have received a census questionnaire or believed they were not included on one. The program also provided an opportunity for people who had no usual address on Census Day to be counted in the census. The Be Counted Form (BCF) contained short form questions (one-hundred percent person data), a question indicating whether the form was being completed for the respondent's whole household, and several additional questions needed to geocode the respondent's address and process the completed forms.

The BCFs were not intended to replace the addressed census questionnaire, so they were only made available to the public in targeted locations in hard-to-enumerate areas. The sites for placing BCFs were identified through the use of Planning Database (based on 1990 census data), and through consultations with local partners.

The Bureau established approximately 85,000 Be Counted sites for Census 2000. The BCFs were available in English, Spanish, Chinese, Korean, Tagalog and Vietnamese.

The BCFs were available in the targeted locations shortly before Census Day and were removed from the sites before the start of NRFU.

2. 1990 Census

In order to allow persons who believed they were not counted an opportunity to be counted, the Census Bureau used a post NRFU campaign called "Were You Counted?" in the 1990 census. This campaign did not start until most census field enumeration activities were completed, thereby reducing the potential for duplicate enumerations.

The "Were You Counted?" campaign printed Were You Counted forms in local newspapers and other media. Anyone believing they were not counted could complete and return a Were You Counted form.

3. Data

Will add forms available and distributed, number of sites, forms returned, forms geocoded, forms accepted in Primary Selection Algorithm.

4. Quality Assurance

No formal quality assurance program was developed for the Be Counted program.

III. Followup

A. Coverage Edit Followup

1. Census 2000

The Census 2000 coverage edit followup (CEFU) included count discrepancy failures, forms with a population count of 7 or more (6 or more for Be Counted forms), and forms with exactly six people listed but a blank total person count.

The universe for this edit was all mail return short forms and long forms, as well as certain Be Counted forms and Internet responses. A computer edit of these cases identified questionnaires that met the criteria for coverage edit followup.

All households that failed edit were contacted by telephone using a computer assisted telephone interview environment. There was no personal visit followup for CEFU cases not resolved over the telephone.

2. 1990 Census

In 1990, coverage edits were automated for urban district offices and clerically conducted in all other district offices. Coverage edits identified five types of coverage edit failures: count failures, forms with a population count of 7 or more, whole household usual home elsewhere (WHUHE) cases, forms where the respondent had problems deciding who to include, and forms with all roster boxes filled (seven people and the reported population count was seven). These edits were applied to all mail back forms and some of these edits were performed on some enumerator forms.

3. Data

Will include count discrepancies, large household count discrepancies.

4. Quality Assurance

The Quality Assurance for the Coverage Edit Follow Update (CEFU) operation ensured that call center agents were handling their calls in a professional, accurate, and prompt manner and collecting complete and accurate data.

A sample of calls was monitored from each telephone agent. After the agent had been monitored for a specified amount of time, the sampling time was reduced. Agents that did not meet performance standards were put on an improvement program, and then removed from the program as necessary. Any evidence of data falsification was grounds for removal from the program. The CEFU operation did not allow for rectification of inaccurate work.

a. QA Plan Characteristics

A sample of calls were monitored from each telephone agent. There were three levels to the agent quality requirement: Novice, Accomplished, and a Performance Improvement Plan.

General Assumptions

- Average call time for the operation is 7.5 minutes
- Full-time Agents work an average of 8 hours a day
- Part-time Agents work an average of 4 hours a day
- Agents are productive 45 minutes of each hour

(1) Novice Characteristics

- Each agent started out at a Novice level.
- Novice agents were monitored for 3 calls per shift.
- Each agent was evaluated with a minimum of 3 calls and 45 minutes.
- If the average score is 85 percent or higher then the agent is moved to the Accomplished Level.

(2) Accomplished Characteristics

- Agents have averaged an 85 percent or higher on previous monitoring sessions.

- If an agent receives two consecutive scores below 85 percent, than the agent is moved to a PIP plan. If an agent has already been on a PIP, then the agent is removed from the program.

(3) Performance Improvement Plan (PIP) Characteristics

- Agents on the PIP have averaged a score lower than 85.
- PIP agents are monitored for 3 calls per shift.
- Each agent is evaluated with a minimum of 3 calls and 75 minutes.
- If the average score is 85 percent or higher then the agent is moved to the Accomplished Level.
- If the average score is less than 85 percent, then the agent is removed from the program.

b. QA results

(1) How well was the QA plan implemented?

TQA Sites	Expected Coverage	Actual Coverage
Site 1		
Site 2		
.		
.		
.		
Site 13		

(2) How well did telephone agents perform during the operation?

TQA Sites	Number of Agents	Agents with 100% Accurate Data During Monitoring	Agents with over 90% Accurate Data During Monitoring	Agents Removed from the Program
Site 1		# %		
Site 2		# %		
.		# %		
.		# %		
.		# %		
Site 13		# %		

(3) What was the quality of our calls?

	Number of Calls	% of Sample	Confidence Interval on Total
Complete and Accurate Data Collected			
Perfect Monitoring Scores			
Passing Monitoring Scores			
Total Number of Calls Monitored (Sampled)			

c. Comparison to 1990 results

There was no Coverage Edit Follow-up performed over the telephone in 1990.

d. Conclusions

Will be completed after results are available. The conclusions will address the quality of the CEFU program as measured by its quality control operation and present the

- Reasons
- Limitations
- Recommendations

surrounding those conclusions.

B. Nonresponse Followup

Nonresponse Followup (NRFU) is an operation for collecting information from respondents who had not returned their questionnaires before the operations started. The NRFU universe was composed of questionnaires that were determined to be undeliverable by the United States Post Office and questionnaires which were not received and processed prior to the cut-off date. During the NRFU operation, the enumerators visited each unit designated for followup and determined the occupancy status of the unit on census day and completed the questionnaire accordingly.

1. Census 2000 - Whole Household Usual Home Elsewhere (WHUHE) probe

There was no question on the Census 2000 questionnaire to determine whether households resided elsewhere. A question was however, asked during NRFU and as part of list/enumerate (L/E) and update/enumerate (U/E). If a respondent during NRFU, L/E, or U/E indicated that the address is a seasonal or vacation home and that they have another place where they live most of the time, they were asked to provide information on that "usual residence."

Enumerators recorded this information on an enumerator questionnaire (EQ). The addresses were matched to the addresses on Master Address File (MAF). If no match was found, we attempted to geocode these addresses. Any addresses that were geocoded in time for field verification were assigned for followup. Once an identification number (ID) was assigned to the EQ it was further processed and ultimately the Primary Selection Algorithm determined its status.

2. 1990 Census - Whole Household Usual Home Elsewhere (WHUHE) probe

In 1990 there was a screener question on the census questionnaire to try to identify households that had more than one residence. WHUHE search records were produced when a household indicated that all household members had another residence where they lived most of the time. The search record collected the address for their "usual residence." These search records went to the search/match operation where they were geocoded and matched to the Address Control File. Ultimately the persons on the search record were compared to persons on the census questionnaire for the "usual residence." If they were not present, they were added.

About 375,000 WHUHE search records were processed, resulting in the addition of an estimated 163,000 persons. A person was added at about 23 percent of the WHUHE search addresses. The evaluation in 1990 estimated a high erroneous enumeration rate but the standard error on the estimate was very high. The 1990 evaluation was based on a sample of search records and required a huge clerical sampling and keying operation. Data for all 2000 cases should be available without the need for clerical intervention.

3. Census 2000 - Mover Probe

The plan for Census 2000 was to identify in-movers during the Nonresponse Followup operation and to ask them if they were enumerated at their census day address. Similar procedures were used during L/E and U/E.

If a respondent who was an in-mover did not recall completing a census form at their census day address, the enumerator completed an EQ for the in-mover household using their census day address. This EQ was processed as a "non-ID'd" form, and we attempted to match it to an address already on the MAF. If an address match was found, that ID was assigned. If no match was found, GEO attempted to geocode these addresses. Any addresses that were geocoded in time for field verification were assigned for followup. Addresses that could not be geocoded or were not geocoded in time for field verification were not added.

The Primary Selection Algorithm (PSA) was the processing mechanism for assuring that these persons were counted correctly. To ensure that all data required for this summary are available, variables were put on the Decennial MAF as well as on other capture files to track the receipt and the processing results.

4. 1990 Census - Mover Probe

A mover probe was used in the 1990 Decennial Census during the Vacant/Delete Followup operation. When an enumerator visited a housing unit and determined that the current occupant was an "in-mover," they collected information on that in-mover households' census day residence. This information was transcribed in the District Office onto search records. The search records were processed in the search/match operation. That operation geocoded the in-mover's address and verified that these individuals were included on the census form for that address. If they were not on the questionnaires for that address, they were added to it. This check was not used again in any of the tests prior to 2000, including the dress rehearsal.

The 1990 evaluation results are documented in the publication, "Programs to Improve Coverage in the 1990 Census." That evaluation estimated that about 95000 search records were received and processed, resulting in about 73000 persons being added to the census. Approximately 36 percent of the search records for movers resulted in an add. The 1990 evaluation was based on a sample of search records and required a huge clerical sampling and keying operation. Data in 2000 should be available for all of these cases, eliminating the need for sampling and for estimation of gains.

Demographic characteristics of adds were also analyzed to assess the effectiveness of this program on the differential undercount. Erroneous enumeration rates were obtained using PES data. Those rates had very high standard errors.

5. Data

Will include workloads, number of movers, and WHUHE cases.

6. Quality Assurance

The QA plan for the NRFU operation was designed to achieve the following objectives:

- Minimize the number of incomplete questionnaires accepted.
- Control falsification of data.
- Minimize data capture errors on data entered into the Operations Control System

The number of incomplete questionnaires was minimized by having the crew leaders or assistants review all questionnaires before submitting them to the office.

To control for falsification, a reinterview program was developed. Cases for reinterview were selected via two means – administrative or random. At the start of NRFU, cases were randomly selected by the OCS2000 (Operations Control System) for each enumerator. Throughout the NRFU operation, cases were selected administratively based upon a comparison of each enumerator's data to the data in the crew leader district. If an enumerator's data was out of tolerance for the crew leader district, then the enumerator was selected for reinterview and cases were chosen. As cases for reinterview were selected, original information was transcribed onto a reinterview form and completed by telephone or personal visit reinterviews with household respondents. A supervisor reviewed the reinterview results, decided if falsification existed, and took the appropriate action.

To minimize the number of data entry errors, each of the three critical fields were rekeyed by the data entry clerk and the operations control system determined if the two entries matched. All discrepancies were rekeyed by the clerk.

a. QA plan characteristics

The critical feature of the QA program is the reinterview component. As mentioned above, the reinterview is divided into two methods: administrative and random. Both methodologies are discussed below with their plan characteristics.

(1) Administrative Reinterview

- QA sample - approximately 1 percent of housing units
- Acceptable number of critical errors = 0
- AOQL = 3 percent

(2) Random Reinterview

- QA sample - approximately 4 percent of housing units
- Acceptable number of critical errors = 0
- AOQL = 5 percent

b. QA results

(1) What type and magnitude of errors or fabrication were experienced during production?

The error rates that we will be calculating are enumerator error, respondent error and falsification.

(2) How much work was corrected or redone due to falsification?

We will provide the number of Assignment Areas (AAS), the number of HUs reworked, and the percent of the total workload that was reworked.

c. Comparison to 1990 results

We will compare the amount of fabrication detected at the national level.

d. Conclusions

Will be completed after results are available. The conclusions will address the quality of the NRFU program as measured by its quality control operation and present the

- Reasons
- Limitations
- Recommendations

surrounding those conclusions.

C. Coverage Improvement Followup

1. Census 2000

Coverage Improvement Followup (CIFU) was an operation developed for Census 2000 that follows NRFU and was designed to improve coverage of housing units (HUs) that were inaccurately classified as vacant or nonexistent in an earlier census operation. Addresses identified for the first time as vacant or delete (nonexistent) during NRFU were included in the CIFU universe. Special cases, such as mail return forms that were checked in but could not be found, were blank, or were not data captured successfully, were also included. Additionally, housing unit additions discovered during the U/L and Urban Update/Leave (UU/L) questionnaire delivery operations, during periodic updates from the US Postal Service

[Delivery Sequence File (DSF) updates], through the local update of census addresses appeals process, and nonrespondents in certain panels of the Response Mode and Incentive Experiment were enumerated in CIFU if no mailback questionnaire was received and captured. Finally, addresses provided by the New Construction update by local and tribal governments were visited by enumerators for the first time during CIFU.

CIFU enumerators attempted to obtain Census Day housing unit and resident information from every residential address identified as part of the above universe. The CIFU operation was conducted in three separate waves as groups of LCOs complete NRFU. An enumerator made a personal visit to each CIFU address in his or her assignment area to either determine the housing unit status as vacant or nonexistent, or collect as much information about the resident(s) and housing unit as possible on Form D-1(E), Enumerator Questionnaire (EQ) Short Form, or D-2(E), Long Form. If the enumerator could not contact a member of the household after repeated attempts in person and telephone, the enumerator attempted to obtain from a neighbor, building superintendent, etc., the required information based on the Census Day occupancy status of the unit. The enumerator turned in work on a daily basis to the crew leader or crew leader assistants for review and check-in. All questionnaires are subjected to a quality review by the crew leader or assistant. Except for CIFU cases identified as vacant/delete in NRFU, an additional quality check was performed on all questionnaires and a revisit was done if the case was returned by the enumerator with a status of vacant or delete.

2. 1990 Census

In 1990 a Vacant/Delete/Movers Check was conducted as part of the Field Followup operation. The Vacant/Delete/Movers Check followed up 2.9 million deleted units and 7.3 million vacant units as classified by NRFU. About 6.4 percent of the deleted units were converted to occupied while 8.7 percent of the vacant units were converted to occupied. A total of 1.5 million persons were added to the census from these conversions representing a coverage gain of 0.6 percent.

The Vacant/Delete/Movers Check was also designed to identify and count post-Census Day movers. For Census 2000 this operation occurred in NRFU.

3. Data

Will add workloads by source and number of vacant/deletes converted to occupied.

4. Quality Assurance

The QA plan for the CIFU operation was designed to achieve the following objectives:

- Minimize the number of incomplete questionnaires accepted.
- Ensure new units were classified correctly.
- Minimize data capture errors on data entered into the Operations Control System (OCS).

The number of incomplete questionnaires was minimized by having the Crew Leaders (CLs) or assistants review all questionnaires before submitting them to the office.

A dependent review was performed to ensure new units were classified correctly. The only cases eligible for this dependent review were those that were not visited in any previous operation and are vacant/delete. The Crew Leader/Assistant visited each designated HU to verify the HU status and population count. If the HU status or population count was incorrect, the CL/CLA completed a blank questionnaire and replaced the previous one. A pass or fail decision was made at the Crew Leader District (CLD) level. One limitation of this QA program is that the dependent review was only conducted on vacant/delete units; occupied units were excluded.

To minimize the number of data entry errors, the data entry clerk rekeyed each of three critical fields and the OCS determined if the two entries matched. The clerk rekeyed all discrepancies.

a. QA plan characteristics

The characteristics of the Dependent Review operation were:
QA sample - approximately 3 percent of housing units
Acceptable number of critical errors = 0
AOQL = 1 percent

b. QA results

(1) How well did the enumerators perform during production?

Total number CLDs	% of CLDs Passed	% of CLDs Failed

(2) What type and magnitude of errors were experienced during production?

Unit Status Nonmatch	Population Count Nonmatch	% of Nonmatches in total workload

(3) How much work was corrected or redone due to failure of a QA checkpoint?

Number of cases reworked	% of workload reworked

c. Comparison to 1990 results

The CIFU operation was not conducted in the 1990 census.

d. Conclusions

Will be completed after results are available. The conclusions will address the quality of the CIFU program as measured by its quality control operation and present the

- Reasons
- Limitations
- Recommendations

surrounding those conclusions.

IV. Data Processing

A. Primary Selection Algorithm

1. Census 2000

The Primary Selection Algorithm (PSA) is a computer program run on the census responses to determine which housing unit and person records are included in the census to represent an enumerated address. More than one response to the census for a given address may be received because there are several ways that households can self-respond, as well as be enumerated by field operations. PSA analyzes these multiple responses

when they occur for a housing unit ID and select from among them the records that most likely represent the actual census household.

2. 1990 Census

The PSA was developed for the 1990 census in response to the possibility of a record being captured more than one time by the data capture system. The Decennial Operation Division (DOD) developed the PSA to select only one capture per ID. The remaining captures were not selected and therefore the person data, when different, were not included in the census. When multiple first form data captures existed, only one record was selected for the census (the primary form). All records "not selected" were dropped. Continuation forms could also be selected, when needed and eligible, as well as search/match forms that added people to the primary household. The occurrence of multiple data captures required a sound and consistent method for choosing which capture would be selected to represent a given ID.

The PSA in 1990 selected a record or set of records for each ID that satisfied the criteria reflected in the algorithm. These criteria included the type of form, the "accept" or "review" status of the form, the comparison of the population count to the number of data defined persons, and the data quality index. Based on these criteria, PSA sorted all eligible data capture records for each individual ID and then selected a primary record. The algorithm also defined when continuation records were required, and selected those records that fulfilled the need. Last, it checked for the Search/Match records, and selected those that met the requirements, allowing only one Search/Match record to be selected for an ID. Person matching between the multiple forms received for an ID was not done.

3. Data

Will add multiple returns by source and the distribution of multiples.

4. Quality Assurance

There are no quality assurance plans spot checking this program. However, extensive software quality assurance checks were undertaken which should ensure that the product was produced according to specifications.

B. Creation of the Census Unedited File

1. Census 2000

The Census 2000 Census Unedited File (CUF) will be created from a match of the census IDs on PSA-selected Decennial Response File (DRF2) records with the Decennial Master Address File (DMAF) universe of addresses determined to represent census housing units. Unlike the dress rehearsal DMAF, the census DMAF will contain all addresses that represent potential housing units as of the creation of the vendor file for the labeling of mail-back questionnaire packages. No addresses will be removed from the mail-out version of the DMAF; statuses of these addresses through subsequent operations will be recorded on the file. Rules that determine whether a DMAF address is to be considered a census housing units will be defined and applied to the DMAF universe based on these statuses. These rules, along with those that determine each housing unit's final status, will be applied during the CUF creation process. The presence of selected DRF2 response records for the DMAF addresses will be taken into account in determining their final housing unit status. Unlike the dress rehearsal process where the imputation of statuses and population counts were postponed to an estimation processing phase, the census CUF creation process will be responsible for this imputation. DMAF addresses that are considered census housing units but for which the final status (occupied, vacant, or delete) and population count is unknown will have this information assigned during CUF creation.

2. 1990 Census

For the 1990 census the equivalent of the Census Unedited File was created from the final Data Capture File (DCF) and the Address Control File (ACF). The resultant file reflected the results of the census response records selected by the Primary Selection Algorithm applied to the DCF, and the final version of the ACF after all ACF Maintenance operations ceased. The housing IDs of the selected DCF records were matched to the IDs of Address Control File address records to define the final census housing unit universe. Address records for which a housing unit status of occupied, vacant, or delete was unknown, and occupied housing units for which a population count was unknown from either response data or the field Collection Control File check in operations, had a status and/or a population count imputation for them by the application of hot decks. The resultant file produced the census housing unit count as well as the final population count for the 1990 census.

3. Data

Will add rates of addresses deleted and rates of imputation for "final status."

4. Quality Assurance

There are no quality assurance plans spot checking this program. However, extensive software quality assurance checks were undertaken which should ensure that the product was produced according to specifications.

REFERENCES

Robinson, J. Gregory (2000). "Accuracy and Coverage Evaluation Survey: Demographic Analysis Results (Prototype)," DSSD Census 2000 Procedures and Operations Memorandum Series B-4.